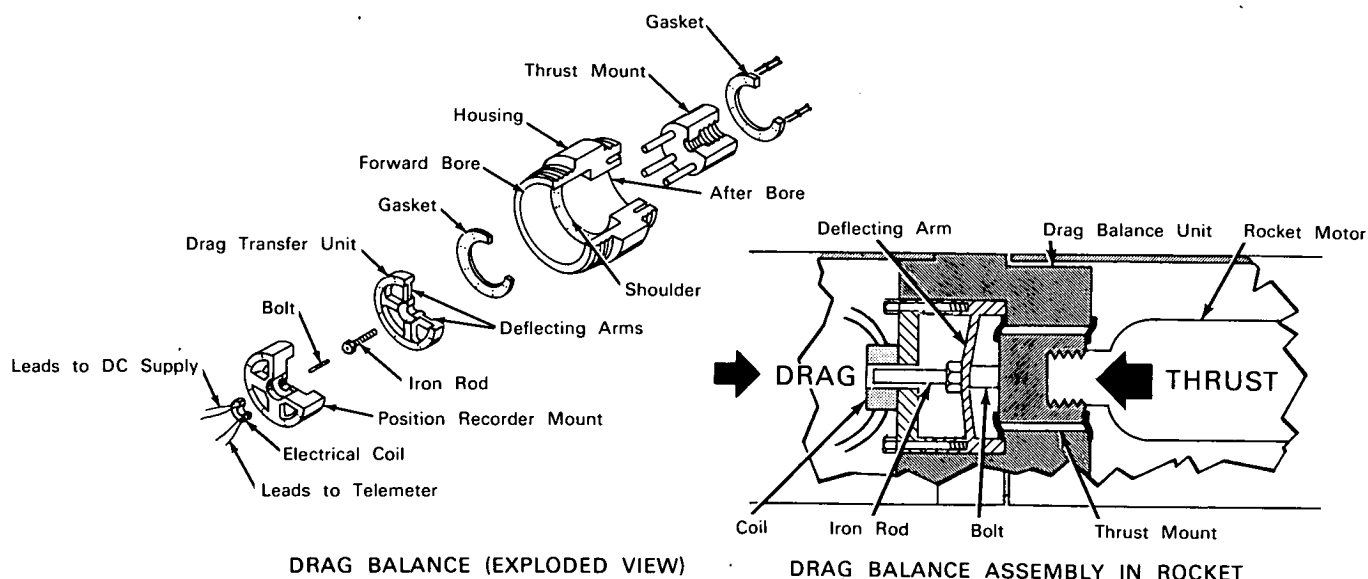


# NASA TECH BRIEF



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## Device Measures Fluid Drag on Test Vehicles



**The problem:** To measure the aerodynamic drag forces acting on a vehicle, such as a rocket, moving through the atmosphere.

**The solution:** An electromechanical drag balance, integrally mounted inside the test vehicle, that senses the drag forces experienced by the vehicle and telemeters the data to a remote receiving station.

**How it's done:** The drag balance device consists of a cylindrical housing with coaxial bores of two different diameters. The forward bore has a diameter sufficient to carry the loads imposed by the forward end of the vehicle, and the after bore has a smaller diameter so that a shoulder is formed about halfway through

the housing. The after bore holds a thrust mount, with space between the inner wall of the bore and the outer wall of the mount for damping fluid. A neoprene gasket at each end of the thrust mount closes the gap between the thrust mount and the after bore. The gaskets are sufficiently flexible to allow relative longitudinal movement between the thrust mount and the after bore. The thrust mount is firmly attached to the forward end of the rocket motor in the test vehicle. A circular drag transfer element, with four equally-spaced radial arms and a diameter slightly less than the forward bore, fits against the shoulder at the housing midsection and is rigidly fixed to the thrust mount by a bolt. A magnetizable rod, such as iron, projects

(continued overleaf)

from the head of the bolt. A position recorder mount similar in construction to the drag transfer element is joined to the drag transfer element by means of bolts. The after end of the bore of the recorder mount is fitted with an insulated electrical coil that is connected to a dc power supply. The coil has a hollow core with a diameter large enough that the iron rod can pass into it without touching the walls. A telemetry unit is mounted in front of the recorder mount so as to move as a unit with the propulsion system.

In operation, the drag forces imposed on the test vehicle and its integrally mounted drag balance cause the radial arms of the drag transfer unit to deflect, the outer ends bending rearward with respect to the inner ends, so that there is longitudinal relative motion in the forward direction of the thrust mount. As this occurs, the iron rod moves into the electromagnetic field of the coil in the recorder mount, varying the coil inductance and thereby the current flowing through the coil. The variation in coil current is directly proportional to the deflection between the ends of the arms of the drag transfer unit. This variation in coil current may be continuously telemetered to a remote station where it may be recorded using conventional equipment calibrated to measure drag in pounds as a function of time.

#### Notes:

1. This device may also be used for testing the hydrodynamic drag characteristics of underwater vehicles. Its main advantage is that drag data can be obtained rapidly under actual test conditions.
2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Langley Research Center  
Langley Station  
Hampton, Virginia, 23365  
Reference: B65-10195

**Patent status:** NASA encourages the commercial use of this invention. It has been patented by NASA (U.S. Patent No. 3,001,395), and royalty-free license rights will be granted for its commercial development. Inquiries about obtaining a license should be addressed to NASA, Code AGP, Washington, D.C., 20546.

Source: Abraham Leiss, Joseph H. Judd,  
and Robert Freeman  
(Langley-34)